

# Droughts, Land Appropriation, and Rebel Violence in The Developing World\*

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## Abstract

Scholars note that rebel atrocities against civilians often arise within rural areas in the developing world. This characterization is not far-fetched, and recent data show that rebel atrocities do predominately occur within rural agricultural regions. Yet, the frequency of such incidents also varies substantially across different agricultural regions and years. What accounts for this observed variation in rebel-perpetrated atrocities against civilians within agricultural areas in developing countries? We develop a formal model to address this question, which contends that severe droughts can decrease food availability, prompting civilians to allocate food for immediate consumption and become increasingly willing to defend their diminishing supplies against rebels. This leads rebels to preempt the civilians' defensive efforts by committing atrocities, which forcibly separate civilians from their lands and food stockpiles. In empirically testing this hypothesis at the sub-national level across the developing world, we find robust support for our game-theoretic model's predictions.

**Keywords:** Droughts, Atrocities, Civil War, Rebel Violence, Croplands

The killing of civilians by armed combatants—which when done intentionally for political motives we term “atrocities”—is widely considered to be one of the most pernicious attributes of modern warfare. It is therefore not surprising that researchers extensively analyzed the potential determinants of this violence within the context of civil conflicts (e.g., Azam and Hoeffler, 2002; Kalyvas, 2006; Wood, 2010; Fjelde and Hultman, 2014). Building upon this body of research, our paper focuses on one key mechanism that we believe may drive rebel groups to perpetrate violence against civilians within rural regions across the developing world: severe droughts. Understanding these dynamics is important given that micro-level evidence (presented below) reveals that atrocities are often committed by rebel groups in rural regions where local food production is more susceptible to the negative effects of drought.

Scholars of rebel violence have used a variety of different approaches to evaluate their theories, including country-year or conflict-year data (Azam and Hoeffler, 2002; Eck and Hultman, 2007), carefully designed case studies (e.g. Kalyvas, 2006; Weinstein, 2007), and grid-cell data from Africa (Fjelde and Hultman, 2014; Wood and Sullivan, 2015). Yet, despite these important contributions, the effect of food production shocks on rebel groups’ strategic incentives to victimize civilians has not been carefully analyzed. This is surprising as empirical evidence suggests that rebel violence against civilians tends to concentrate not only in rural areas, as current theories might predict, but specifically in areas that produce food for proximate consumption. Indeed, a close examination of a *global sample* of newly released data on rebel atrocities at the *disaggregated* within-country “grid-cell year” level (PITF, 2009),<sup>1</sup> which also includes rebel atrocities in locations not currently experiencing active fighting between rebels and government forces, reveals two intriguing details that current theories of rebel violence do not adequately explain. Rebel-perpetrated atrocities in the developing world (i) *predominately* arise not only in rural regions, but in agricultural areas specifically (99.6% of all incidents); and (ii) often occur during periods that do not experience active fighting between rebels and government forces within these same agricultural regions (26.4% of all incidents). This evidence suggests that a critical component is missing from

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<sup>1</sup>I.e., “cells” of approximately 55km x 55km around the equator (Tollefsen et al., 2012).

our understanding of strategic rebel violence: rebel groups' reliance upon local agricultural resources for their operations and survival. Anecdotal evidence supports this interpretation. For instance, Naxalite rebels in the Bastar, India used violence to expropriate food supplies from the local population during 2004, a year with exceptionally low food production, but did not do so in other years with more abundant food production (Gregory, 2013; Singh, 2006). We argue that this spatiotemporal variation in atrocities is a symptom of one specific, yet understudied, incentive for rebel violence: guaranteeing food security in response to food production shocks.

More specifically, the global grid-cell variation and anecdotal examples discussed above lead to two important and related questions explored here: What drives rebel groups to commit atrocities against civilians as a result of food security concerns in agricultural regions? More broadly, what accounts for the observed variation in the frequency of atrocities committed by rebels across agricultural areas in developing countries? To answer these questions, we develop a game-theoretic model that analyzes strategic interaction between two players: (i) a rebel group and (ii) a group of civilians that reside and work in a region where agricultural (food) production is the main source of income and sustenance. This model thus examines an important dynamic that to our knowledge has not received sufficient attention in extant research, namely, the "strategic competition" over croplands between the rebel group and civilians who farm the land to produce food.

We explain rebel violence against civilians by modeling atrocities as a rationally employed "eviction strategy" under the straining conditions of drought. Treating drought as a causal mechanism for violence has precedence in studies of conflict (e.g., Burke et al., 2009), but has not yet been applied to the empirical study of atrocities. Building on this premise, we examine how severe droughts, which have substantial negative effects on cropland production in developing countries where they commonly occur, affect the strategic calculi of both (i) rebels, and (ii) the civilian population. Our formal model posits that severe droughts diminish agricultural resources, which in turn increases the rebels' incentives to seize food

resources *and* the civilians' incentives to defend their dwindling food supplies. In equilibrium, the rebels expect that over time seizing agricultural resources may become too costly. This compels them to *preempt* defensive efforts by using atrocities *as a strategy* to forcibly evict the civilians from their homes and croplands, as atrocities compel civilians to flee their lands or otherwise give up agricultural resources. We broadly evaluate these expectations by examining agricultural production and violence in Thailand and India; and then empirically validate these contentions using spatially disaggregated atrocities data for the entire developing world.

Our focus on strategic interaction between rebels and civilians during times of drought makes several contributions to the literature. First, our formal model explains why rebels in developing countries often commit atrocities against civilians not only in the countryside—as current theories (e.g., Kalyvas, 2006; Weinstein, 2007) may predict—but specifically in “croplands,” where agriculture (i.e., food production) is the main source of income and consumption. In treating cropland as a vital natural resource, we uncover an important mechanism that explains why violence against civilians is more likely in the countryside: production and consumption of agricultural produce. This treatment of cropland as a natural resource is consistent with Wood's findings that some rebels “engage in violence against civilians...to acquire necessary resources and prevent collaboration with government forces” (2010, 612); *and* with Weinstein's contention that violence may occur “[w]here groups lack economic endowments, [and] rebel leaders can promise to provide private rewards expecting that the group will gain access to material resources at some point” (2005, 605). Our drought-based theory also relates to research showing that asymmetric reductions in rebel capabilities, for example via military interventions (Wood, Kathman and Gent, 2012), lead rebels to pursue violence against civilians; Hultman's (2007) finding that battlefield losses compel rebels to commit violence against civilians; and finally to past characterizations of atrocities as arising due to civilians' control over agricultural lands and the disconnect that this causes between these civilians and invading rebel movements (Mkandawire, 2002).

Lastly, our subnational developing country assessment of the above claims demonstrates that food resources-related rebel atrocities are not only confined to African countries—which are the primary focus of current spatially disaggregated studies of atrocities (Azam and Hoeffler, 2002; Fjelde and Hultman, 2014; Wood and Sullivan, 2015)<sup>2</sup>—but also occur with alarming regularity in developing states in Asia, the Middle-East, and Latin America. Hence, this paper advances the study of rebel-perpetrated atrocities by highlighting a crucial, yet understudied, dynamic of violence, and by assessing its effect on a spatially disaggregated *global* sample.

## Background Discussion

Numerous studies highlight the negative effects of drought on consumption in developing countries (e.g., Roncoli, Ingram and Kirshen, 2001; Cutler, 1986). This change in consumption habits, alongside civilians’ (Burke et al., 2009) and rebels’ (Henk and Rupiya, 2001) reliance on locally produced food,<sup>3</sup> suggests that there will be increased competition over these resources. With developing country croplands expected to experience the worst of global warming’s drought-associated effects (Vidal, 2013; Burke et al., 2009), our central question is thus: *when* will strategic interactions related to the use of cropland for food consumption between rebels and civilians in developing countries induce rebels to commit atrocities? To answer this question, our model assumes that rebels and civilians interact in rural cropland regions, and that both players (i) value this cropland for consumption and (ii) must account for the effect of possible negative shocks such as a severe drought on their cropland.

These very features have been observed in the Horn of Africa, where structural constraints on farmers’ and pastoralists’ capital stocks, when combined with droughts, have generated increased risks of widespread violence, social breakdown, and formations of self-defense groups (Mkutu, 2001). Droughts also intensified competition over agricultural output

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<sup>2</sup>Note that a number of insightful *non-spatially disaggregated* global studies of atrocities do exist (e.g., Wood, 2010; Wood and Kathman, 2013; Valentino, Huth and Balch-Lindsay, 2004).

<sup>3</sup>Which is especially likely in developing countries where the infrastructure in rural areas is may be frail.

and croplands between farmers and rebel groups like the Naxalites, Janashakti, and Agami Yug in India (Gregory, 2013; Singh, 2006); and the Barisan Revolusi Nasional-Coordinate [BRN-C] in Thailand (Davis, 2005; Srirai, 2008). Further, these dynamics often lead rebels to perpetrate atrocities in these agricultural regions (Singh, 2006; Srirai, 2008).

The above examples highlight how violent interactions between civilian farmers and rebel groups often unfold. With the onset of drought, rebel groups are driven to expropriate the land of local civilian farmers to obtain the output stored on these lands and assure a steady supply of food. In anticipation of this, the farmers can form self defense militias, as happened, for instance, in India (Singh, 2006), Somalia (Hansen, 2013), Sierra Leone (Keen, 2005), Uganda (Mkutu, 2001), and Peru (Gitlitz and Rojas, 1983). Aware of this possibility, the rebels have increased incentives to prevent militia formation and to facilitate expropriation using violence (Singh, 2006; Srirai, 2008). Our model illustrates how these dynamics lead to atrocities against civilians during severe droughts.

The idea that rebels strategically commit atrocities against civilians to attain specific goals is well established in extant studies (e.g., Kalyvas, 2006; Weinstein, 2007; Wood, 2010; Salehyan, Siroky and Wood, 2014; Fjelde and Hultman, 2014).<sup>4</sup> We contend that securing sustenance in the face of sudden scarcity is one goal that justifies such violent means. Our model further shows that atrocities perpetrated by rebels are most likely in rural regions where the government’s security presence is negligible (e.g., Kalyvas, 2006; Mkandawire, 2002), especially considering that, as Hendrix and Brinkman (2013, 4) note, “[r]ebel movements typically do not grow their own food and depend on voluntary or *coerced contributions* from the population” (emphasis added). The rebels’ strategy of expropriating the civilians’ arable land for the purpose of consumption, and the civilians’ strategy of defending their land, leads to a “contest” over the latter’s agricultural property in our game model. We show that drought *intensifies* this contest, inducing rebels to use atrocities to maximize their chances of successful land-grabbing. This competition can be especially pronounced if

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<sup>4</sup>While some studies focus on atrocities perpetrated by state actors (e.g., Valentino, Huth and Balch-Lindsay, 2004; Koren, 2014), analyzing state-led atrocities is beyond the scope of this paper.

rebel groups move into areas where they do not enjoy traditional authority. In these cases, as Mkandawire argues, “[h]aving little in common with the peasantry, and nothing to offer it, they resort to violence as the only way to control it” (2002, 181). We confirm these dynamics below in demonstrating that, to deter civilians from forming defense militias and thus increase the probability of successfully evicting the civilians expropriating their croplands, the rebels are more likely to resort to atrocities during periods of severe drought.<sup>5</sup>

Our broader argument is also consistent with studies that emphasize the importance of “greed” within civil conflicts, especially the contention that armed actors might use violence to secure valuable resources (e.g., Azam and Hoeffler, 2002; Wood, 2010). For instance, rebels in Somalia and Burundi have expropriated agricultural land from local farmers both for consumption and as a “reward” to attract volunteers (Hansen, 2013). Our model highlights the resource-based motivations of *agents*, specifically rebels and civilians, to secure sustenance during droughts, focusing on food access as a mediating factor as suggested by past research (e.g., Theisen, Gleditsch and Buhaug, 2013). Assuming that “[e]very rebel movement aspires to some form of sedentary existence or respite in ‘liberated zones’” (Mkandawire, 2002, 200), we hypothesize that the opportunity costs of migration in response to drought are typically high, and entail abandoning stockpiled food or switching from cattle to other forms of livestock that are more transportable across long distances. Rebel groups might thus prefer to operate locally, and supplement their dwindling stocks by extracting additional supplies from the local population, especially as the value of crop stocks rises.

## The Model

Assume two players who interact in the rural area of a developing country: a rebel group  $r$  (that consists of group members) and a set of rural civilians  $b$  (i.e., workers)<sup>6</sup> who work as agricultural labor. The rural civilian laborers  $b$  work on their land  $L$  to cultivate crops—

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<sup>5</sup>We provide additional anecdotal evidence of these dynamics in the Supplemental Appendix.

<sup>6</sup>The rebel group is fully denoted as  $r_j$  where  $j = \{1, 2, 3...m\}$  and the rural civilian workers as  $b_i$  where  $i = \{1, 2, 3...n\}$ ; subscripts  $i$  and  $j$  are suppressed for notational convenience. Given our theoretical goals, we focus on strategic interaction between  $r_j$  and  $b_i$  (“ $r$  and  $b$ ”) the civilians working on the cropland.

$L$  is hereafter labeled as cropland—to produce food for consumption. “Total production of food” comes from the Constant Elasticity of Substitution (CES) production function  $\pi(L, b, K) = [\gamma(\alpha L^\rho + (1-\alpha)b^\rho + \beta K^\rho)^{\frac{1}{\rho}}]^\gamma$ <sup>7</sup> which includes three factors of production: cropland  $L$ ; physical capital  $K$  (farm machinery, plows, houses where crops are stored); and rural civilian labor  $b$ . In this CES function,  $\alpha \in [0, 1]$  is the relative weight of production inputs cropland  $L$  and labor  $b$ ;  $\beta \in [0, 1]$  is the weight attached to capital  $K$ ;  $\rho \leq 1$  is the elasticity of substitution; and  $\gamma > 0$  the productivity parameter. Let  $\phi \in \{0, 1\}$  be the incidence of drought where  $\phi = 1$  denotes severe drought; hence the *remaining* share of cropland the civilians use for production and consumption when drought occurs is  $(1 - \phi)L$ . The marginal productivity of this remaining cropland is  $(1 - \phi)\pi(L, b, K)$ . The rate at which the civilian workers stockpile agricultural produce (i.e., food) generated from their remaining cropland for consumption is  $s$ . The total cropland produce stockpiled by  $b$  for consumption is thus  $s(1 - \phi)\pi(L, b, K)$ .

The rebels  $r$  seek to expropriate the civilians’ cropland  $L$  to (i) gain access to the agricultural produce (for consumption)<sup>8</sup> that the civilians  $b$  store/hide in houses located on the cropland; and (ii) control the cropland. Expropriating and controlling  $L$  also gives the rebels access to the civilians’  $b$  labor. The rebels  $r$  decision of whether or not to keep the workers on their cropland during a drought is crucial as they are aware *ex ante* that the civilians may oppose  $r$ ’s goal of expropriating and controlling  $L$ . Thus, as anecdotal evidence suggests, the rebels may strategically employ atrocities  $a$  (e.g., killings) against the civilian workers  $b$  to forcibly expropriate their cropland, while the civilians’ may form a militia  $m$  of forces drawn from  $b$  to defend against expropriation and potential atrocities. Let  $p$  be the probability with which the civilian labor  $b$  successfully defend against  $r$ . Given  $m$  and  $a$ , we let  $p$  follow a standard “contest success function”,  $p = \frac{m}{m+a}$  (e.g., Skaperdas, 1996). The probability with which the rebels (civilians) successfully (fail to) expropriates (defend) the rural civilians’

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<sup>7</sup>Developed by Arrow et al. (1961). This CES function is described further in the Supplemental Appendix.

<sup>8</sup>Conversely, if  $r$  chooses to migrate to other areas when  $\phi = 1$ , then  $r$  is likely to move away from the local cropland  $L$ , reducing their prospects of expropriating and gaining access to food stockpiles. Migration is thus a risky strategy for  $r$ , who need the stockpiled food on  $L$  for consumption when  $\phi = 1$ .

(their) cropland is  $(1 - p) = 1 - \frac{m}{m+a}$ .

Let  $f_r$  be the rebel group's financial resources used for different activities, including expropriation. If  $r$  succeeds in expropriating the civilians' cropland with probability  $(1 - p)$ , they obtain the benefit  $s(1 - \phi)\pi(L, b, K)$  as controlling  $L$  provides  $r$  with access to  $b$  and the stockpiled food located on  $L$ . The rebels incur costs  $ac_r$  for committing atrocities  $a$ .<sup>9</sup> The rebels' costs of retaining the workers  $b$  on the expropriated cropland is given by the convex function  $c_r(\frac{1}{2}\theta b^2)$ , where  $\theta > 0$  is the weight  $r$  places on the costs of retaining  $b$ .<sup>10</sup> The rebel group's total cost is thus  $c_r(a + \frac{1}{2}\theta b^2)$  and their net utility function is

$$u_r = f_r - c_r(a + \frac{1}{2}\theta b^2) + (1 - p)[s(1 - \phi)\pi(L, b, K)] \quad (1)$$

The rebel group's optimization problem is to maximize (1) with respect to  $a$  subject to the constraint  $c_r(a + \frac{1}{2}\theta b^2) \leq f_r$ . Let  $mc_b$  be the civilian workers' costs of forming a self-defense militia  $m$ .  $f_b$  is the civilians financial resources used for food production.  $s(1 - \phi)\pi(L, b, K)$  is the total cropland output stockpiled for consumption. Since the civilians successfully defend their cropland from  $r$  with probability  $p = \frac{m}{m+b}$ , their net utility function is

$$u_b = f_b - mc_b + p[s(1 - \phi)\pi(L, b, K)] \quad (2)$$

The rural civilians optimization problem is to maximize (2) with respect to  $m$ , subject to  $mc_b \leq f_b$ . The sequence of play, influenced by the examples of rebel group-rural civilian interaction discussed below, is as follows. A severe drought  $\phi$  occurs that is observed by  $r$  and  $b$ . Having observed  $\phi$ , the civilians stockpile food  $s$  from their surviving cropland for consumption. The rebels then choose whether or not to expropriate the civilians' cropland using atrocities  $a$  given  $\phi$ , while the civilians choose  $m$  given  $r$ 's choice of  $a$ . The players' actions influence  $p$  and  $(1 - p)$ , and subsequently their realized payoff.

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<sup>9</sup>Includes operational costs (e.g. mobilization costs of recruiting individuals) to carry out atrocities.

<sup>10</sup>That is, the costs of keeping the workers as bonded or regular wage-earning workers.

*Equilibrium Result and Comparative Statics*

**Lemma 1:** *In the subgame perfect Nash equilibrium of the game between  $r$  and  $b$ , the (i) optimal agricultural produce (food) generated from the cropland  $L$  and stockpiled by the rural civilian labor  $b$  for consumption is  $s^* = \frac{f_r}{(1-\phi)\gamma(\alpha L^\rho + (1-\alpha)b^\rho + K^\rho)^{\frac{1}{\rho}}}$ . The optimal militia size  $b$  can form for defense against the rebels  $r$  is  $m^* = \frac{s(\phi[(L+K) - \phi b]^2)}{4\alpha(1+\phi)}$  while the marginal productivity of  $b$  working on  $L$  is  $(1-\phi) \left[ \gamma(\alpha L^\rho + (1-\alpha)b^\rho + K^\rho)^{\frac{1}{\rho}-1} \right] (1-\alpha)b^{\rho-1}$ . (ii) The optimal atrocities level committed by  $r$  is  $a^* = \sqrt{\frac{m}{\phi}} s(\phi[(L+K) - \phi b]^2) - \frac{m}{\phi}$ .*

The **formal proof** of Lemma 1 is provided in the Supplemental Appendix. Two sets of comparative static results derived from the subgame-perfect Nash equilibrium in Lemma 1 explain when and why the rebel group will commit atrocities against the workers  $b$ . The first set of comparative static results are

**Proposition 1:** *When severe drought occurs ( $\phi = 1$ ), (i) the rural civilian labor will stockpile in equilibrium agricultural output  $s^* > 0$  from their cropland for consumption and (ii) the rebels' strictly dominant strategy is to expropriate the civilians' cropland.*

The logic behind Proposition 1 (the propositions' **formal proof** is in the Supplemental Appendix) that provides the foundation for Proposition 2's prediction (stated below) is as follows. First note that when severe drought occurs ( $\phi = 1$ ), it adversely affects the civilians' consumption habits (formally proven in "proof of claim 1" in Supplemental Appendix). The civilians compensate for this adverse effect by stockpiling food  $s^* > 0$  generated from their surviving arable cropland (part (i), Proposition 1); this action ( $s^* > 0$ ) is common knowledge to all the players. In response, the rebels  $r$  seek to expropriate the civilians' remaining arable cropland if  $s^* > 0$  to gain *direct access* to  $s^*$ , since the stockpiled food is located on the cropland itself. Indeed, the opportunity to gain direct access to  $s^*$  is a powerful motivation to expropriate the cropland, as the rebels require the food stockpiled on  $L$  for their own immediate consumption in a drought.<sup>11</sup>

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<sup>11</sup>Conversely, transporting the stockpiled food from the cropland to another location imposes transaction costs on the rebels, and also increases the possibility that the food may rot during the process. This further incentivizes the rebels to obtain and consume stockpiled food.

Further, expropriating the civilians’ cropland allows the rebels not only to control the physical source of the stockpiled food, but also the surviving arable cropland. Controlling this land is crucial; it facilitates continuous access to the gathered food  $s^*$  for  $r$  and, as a result, helps the rebels to maintain their consumption levels during a drought and secure a steady supply of stockpiled food. This allows  $r$ ’s leaders to make credible promises to group members about their ability to obtain and (re)distribute the stockpiled food (see “proof of claim 2”, Supplemental Appendix), which helps recruitment and fosters cohesion within  $r$ . Finally, a severe drought intensifies competition between the civilians and the rebels over consuming  $s^*$ , and sharply curtails  $r$  and  $b$ ’s incentives to share consumption of  $s^*$ , now a significantly *limited finite resource*. Such competition reinforces the rebels’ need to control the cropland to exploit the civilians’ land for their own consumption. It also ensures that cropland expropriation emerges as a strictly dominant—and cooperation with the civilians over sharing  $s^*$  strictly dominated— strategy for  $r$  when  $\phi = 1$  (part (ii), Proposition 1).

Statistically evaluating our claim that rebels choose to expropriate croplands during droughts is difficult, because (to our knowledge) no cross-national data on food stockpiling and agricultural expropriation is publicly available. Yet the following examples described in detail in the Supplemental Appendix reveal the plausibility of these claims. Consider Bastar and Dantewada — agricultural districts in Chattisgarh, India where rice is the predominant crop — where Naxalite rebels actively operate (Singh, 2006; Pandita, 2011). When a severe drought struck Bastar and Dantewada in 2004, villagers in these two districts “accumulated rice in numerous *anaj ghars* located on their rice fields” (Singh, 2006, 71). As predicted by our theory, this induced the Naxalites to expropriate the villagers’ rice fields to get food for sustenance, and to feed the rank and file of their group<sup>12</sup>, and ensure a steady food supply given uncertainty created by the drought (Gregory, 2013). In Somalia, civilians in Lower Juba’s rural agricultural region gathered and hid (in houses) food for consumption when this region was affected by a drought in 2011; this invited land-grabbing attempts by Al Shabaab

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<sup>12</sup>Ministry of Home Affairs, *Annual Report 2004–05* (Official Documents Section in the Library of the Central Secretariat—Shastri Bhawan), Government of India, New Delhi (2005: 39-40)

rebels (Hansen, 2013). Further, in the Songkhla province of Thailand — where rice is the predominantly cultivated crop — a comparable rebel group, the Barisan Revolusi Nasional-Coordinate (BRN-C), operates. During the intense drought of 2004, farmers working in the rice-producing areas of Rattaphum, Na Mom and Bang Klam in Songkhla province stored significant amounts of rice on their rice fields for future consumption (Srirai, 2008; Rattanachaya, 2004, 47-48). This influenced the BRN-C to decide to raid and capture rice fields in Rattaphum, Na Mom, Bang Klam to acquire, distribute among group members and eat rice stored by farmers in the rice fields (Rattanachaya, 2004; Srirai, 2008).

To provide more systematic quantitative evidence for the link between droughts and land expropriation by rebels we geocoded data on rainfall and agricultural land expropriation by rebels at the *district-level* in India and the *province-level* in Thailand. In India, rebel groups such as the Naxalites, Agami Yug, and Janashakti operate across the following seven states (where cropland expropriation and killing of civilians by rebels occur): Andhra Pradesh, Bihar, Chattisgarh, Jharkand, Madhya Pradesh, Orissa, West Bengal. As discussed in the Supplemental Appendix, we use these data to assess the link between severe drought and expropriation of cropland by rebels in 58 agricultural districts within the aforementioned seven Indian states between 2002 and 2009 (the years for which data were available) where rice, bajra, and kharif are produced for consumption (NREGA, 2010). Analysis of this district-year sample (see Supplemental Appendix) reveals that severe droughts *significantly increased* the extent of agricultural property expropriation by rebels in India during 2002-2009. These results are statistically significant, substantively sizable, and robust to many model specifications, including penalized maximum likelihood estimation.

We conducted a similar analysis for Thailand. Studies on rebel violence show that over 90% of the civilians killed by rebel groups (e.g., the Pattani United Liberation Organization and BRN-C) in rural areas resided in 18 provinces (plotted and listed in the Supplemental Appendix) (Davis, 2005; Helbardt, 2011). These provinces produce 80% of Thailand's five key crops: rice, sugarcane, rubber, corn, and maize.<sup>13</sup> Correspondingly, we geocoded data

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<sup>13</sup>See National-Statistics-Office (1985). This source is listed in the Supplemental Appendix.

on rainfall, cropland expropriation by rebels, and other key indicators for each of these 18 Thai provinces from 2004 to 2010. As described in the Supplemental Appendix, statistical analysis from the Thailand province-year data reveals that the impact of drought on land expropriation by rebels in our Thailand province-year sample is again *positive and statistically significant* across many model specifications. Thus, our Thailand and India analysis, and anecdotal evidence, suggest that our argument that rebels expropriate agricultural land from civilians during severe droughts is plausible.

Yet note that in equilibrium the rebels recognize *ex ante* that when  $\phi = 1$  they face a significant trade-off *ex post* in respect to expropriation. On the one hand, they can peacefully co-opt or capture the civilian workers  $b$  and use them as labor for agricultural production on these expropriated croplands. But retaining the workers  $b$  on  $L$  will compel  $r$  to share the food stockpiles with  $b$ , at least up to the amount necessary for survival. On the other hand, the rebels can *expel* these civilian workers from their land and consume the stockpiled food without sharing it. Our model suggests that when severe drought occurs, the rebels address this trade-off by choosing *not* to employ the civilians for agricultural production, expelling (i.e., evicting) them from the cropland instead. Further, as shown in Proposition 2,  $r$  will strategically employ atrocities against the civilians to evict them from  $L$  during a drought. Before proceeding to Proposition 2 however, we present three comparative statics derived from Lemma 1 to explain why the rebels will evict the civilian workers from  $L$  when  $\phi = 1$ .

First, during a severe drought, the civilian workers productivity exhibits sharp diminishing marginal returns ( $\pi_b < 0$ ,  $\pi_{bb} < 0$  for  $\phi = 1$ ). The rebels thus understand *a priori* that their *returns* from keeping these workers on the expropriated croplands is *negative* in this context.<sup>14</sup> This is hardly surprising. Severe droughts erode the workers' physical ability to work owing to water shortages, which reduces their capacity to work in the fields. Based on this formal result, we argue that labor's declining productivity during droughts is a key reason for why rebels *would not* keep workers on the expropriated cropland, but instead evict them. Second, comparative statics show that during a severe drought, the finite stockpiled

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<sup>14</sup>See Supplemental Appendix for formal proof of this claim.

food  $s^*$  available post-expropriation will shrink rapidly *if* the civilian workers stay on the expropriated cropland, because both the rebels and civilians will consume it (see Supplemental Appendix for proof of this claim). Hence the presence of civilians on the expropriated croplands substantially exacerbates population pressures with respect to consumption of the finite stockpiled food during a drought, thus prompting “food insecurity” (Urdal, 2008; Wischnath and Buhaug, 2014). Such population pressures on limited food supplies during drought engender more uncertainty about food consumption, which further incentivizes the rebels to evict the civilians from their cropland to ensure that there are less civilians to feed and thus more food available for  $r$  to consume (see Supplemental Appendix for proof of this claim).

Third, comparative statics show that the civilians recognize that the rebels cannot credibly commit to *not* forcibly seize  $b$ 's cropland  $L$  and evict workers from  $L$  when  $\phi = 1$  as  $r$ 's incentives to do so is common knowledge. This encourages the civilians to form a militia  $m$  to defend their agricultural land from confiscation by  $r$  (rather than co-operate with the rebel group), as expropriation and eviction by  $r$  will deprive the civilians from consuming food stockpiles on  $L$ . Hence, the workers  $b$  cannot credibly commit not to form a militia. Correspondingly, the rebels recognize that *if* the civilians form a *sizable* militia to defend their stockpiled food and cropland from  $r$ ,<sup>15</sup> then  $r$ 's costs from seizing and exploiting the civilians' cropland for food consumption will rise substantially and become prohibitive (see Supplemental Appendix for proof of this claim). Thus the rebels will have additional incentives to forcibly *evict* the civilian workers from their cropland  $L$  as these workers cannot form a militia to oppose  $r$  when they are forced to flee from  $L$ .

Historical evidence from the 2004 drought in the rice fields of Bastar and Dantewada (in India) and Songkhla in Thailand corroborate these three comparative static claims. For instance, India's Home Ministry reported that after the monsoon failed in 2004, farmers and *adivasis* residing in Bastar and Dantewada discussed formation of defense groups to defend

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<sup>15</sup>Meaning that  $m$  reaches an upper threshold level  $\bar{m}$  (formally characterized in Lemma 1's proof).

their agricultural land from being raided by the Naxalites.<sup>16</sup> As described in detail in the Supplemental Appendix, the Naxalite rebels believed that if the farmers in these two districts formed self-defense militias, then these farmers would make it difficult for the Naxalites to get access to the peasants' rice fields and crops stored in *anaj ghars*, militarily challenge them and deprive the Naxals of food for consumption<sup>17</sup> during the drought (Pandita, 2011; Singh, 2006, 31-32). The Naxalites in Bastar and Dantewada thus took the "critical decision" of expelling the peasants and adivasis from their farmlands<sup>18</sup> so that the farmers could *not* hinder their appropriation goals (Singh, 2006; Shankar, 2006). This eviction decision was further reinforced by their belief that owing to the drought the farmers would be an unproductive workforce who would not add much to crop production (Pandita, 2011; Singh, 2006).

Similarly, researchers and media sources suggest that farmers in Rattaphum, Na Mom and Bang Klam in Songkhla (Thailand) during the 2004 drought discussed among themselves to put together defense associations<sup>19</sup> to deter the BRN-C from appropriating their rice fields. The BRN-C felt that such self-defense militias would seriously impeded their goal of capturing and controlling rice fields in Rattaphum, Na Mom and Bang Klam<sup>20</sup> situated in Songkhla (see Supplemental Appendix for more details). The BRN-C leaders also viewed the continued presence of farmers in the rice fields of Songkhla province as a financial liability given their diminished capacity to work because of water scarcity<sup>21</sup> resulting from the failed 2004 monsoon (Janchitfah, 2004; Rattanachaya, 2004; Srirai, 2008). The BRN-C's view of farmers as a liability and threat to their land-grabbing goals influenced them to *expel* the peasants from the rice-fields of Rattaphum, Na Mom and Bang Klam<sup>22</sup> which they sought to appropriate (Janchitfah, 2004; Srirai, 2008). Farmers also sought to form self-defense groups

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<sup>16</sup> *Ministry of Home Affairs*, "Status Paper on the Naxal Problem," 18 August 2004, Internal Security Division. Government of India, New Delhi; also see Shankar (2006).

<sup>17</sup> *Ministry of Home Affairs*, "Status Paper on the Naxal Problem," *Ibid.*, pp. 11-12.

<sup>18</sup> *Planning Commission of India*. 2008. "Development Challenges in Extremist Affected Areas: Report of an Expert Group." Government of India: New Delhi.

<sup>19</sup> Chongkittavorn (2004, 17).

<sup>20</sup> See Chongkittavorn (2004).

<sup>21</sup> Srirai (2008, 21).

<sup>22</sup> Srirai (2008).

to protect their agricultural land from rebels during intense droughts — which induced local rebels to seek to evict these farmers — in Lower Jubba (Somalia) during the 2011 drought (Hansen, 2013) and in Arequipa (Southern Peru) in 1982 (Gitlitz and Rojas, 1983).

Thus the preceding examples and comparative statics show that the declining productivity of labor, commitment problems between  $r$  and  $b$ , and the possibility that the civilian workers may form a militia to oppose  $r$  strongly encourages the rebels to evict rather than retain the workers on the cropland when  $\phi = 1$ .<sup>23</sup> Eviction also accomplishes another goal for the rebels which further encourages them to expel the workers: it reduces the rebels' costs of confiscating the cropland  $L$  as the workers cannot undertake the necessary organizational effort to develop  $m$  to defend  $L$  when forced to flee. Given the rebels' rationale for evicting the civilians from  $L$  and the result in Proposition 1, all of which arise when  $\phi = 1$ , the final set of comparative statics from our model (stated in Proposition 2) suggest that during a severe drought, the rebels will commit atrocities against the civilians to facilitate eviction and increase the probability of successfully grabbing cropland and food supplies.

**Proposition 2:** *During a severe drought ( $\phi = 1$ ), the (i) equilibrium level of atrocities  $a^*$  committed by the rebel group  $r$  strictly increases; and (ii) probability  $(1 - p)$  with which  $r$  successfully seizes the civilian workers' cropland strictly increases for  $a^* > 0$ .*

The intuition behind Proposition 2 (the proposition's **formal proof** is in the Supplemental Appendix) is as follows. To start, recall that the finite food stockpiles  $s^*$  will shrink rapidly in a severe drought if the civilian workers  $b$  remain on the expropriated cropland  $L$  as both  $b$  and  $r$  need to consume these stockpiles for survival. Hence if the civilian workers remain on  $L$ , then the available amount of stockpiled food obtained from  $L$  (post-expropriation) will be *insufficient* for basic sustenance required for survival by the rebel group, which  $r$  understands *ex ante*. As suggested by scholars, under severe drought conditions, insufficient crop stockpiles can engender and accentuate food insecurity and competition over finite food supplies between residents (civilian workers and the rebels in our case) in rural agricultural areas of developing states (Wischnath and Buhaug, 2014; Fjelde, 2015, 527). Building on

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<sup>23</sup>See the Supplemental Appendix for formal proof of this claim.

this insight, our model suggests that such food insecurity and competition over finite food supplies encourages the rebels to not only evict the civilians  $b$  from  $L$  but also commit atrocities (during expropriation) against  $b$  — as these civilians are easy targets for predatory rebel groups— to facilitate eviction when  $\phi = 1$  (part (i), Proposition 2). Three reasons derived from our model account for this claim.

The first reason is that killing civilian workers allows the rebels to reduce the number of civilians, thus helping  $r$  to curb population pressures on the finite stockpiled food resource. This ensures that the rebels can consume a greater share of the stockpiled food because a greater amount of  $s^*$  obtained from the cropland is available to  $r$  for consumption when the civilians are removed. The second reason is that killing the workers  $b$  allows the rebels to send a powerful *observable* signal to these workers that they ( $r$ ) will *not* share the stockpiled food on  $L$  with  $b$  during the drought but rather evict  $b$  from the cropland. As such, the signal sent to the civilian workers during a severe drought — by  $r$ 's strategy of increasing the frequency of atrocities against the workers—helps the rebels to generate fear among  $b$ . This fear influences the civilians to flee from their cropland, which facilitates the rebel group's goal of forcible eviction and land expropriation, including the stockpiled food on  $L$ .

Third,  $r$  recognizes that committing more atrocities against the civilians  $b$  will allow the rebels to *credibly* threaten the civilians' physical integrity in equilibrium. The threat is credible since the rebels' *net utility* from committing atrocities  $a$  is higher than their benefits from retaining the civilians  $b$  on  $L$  during a drought which is reinforced by the workers' declining productivity (see Supplemental Appendix for formal proof of this claim). The credibility of the threat produced by committing atrocities helps  $r$  to compel  $b$  to flee from their cropland which makes it unlikely that the civilians will form a militia therein leading to a decrease in the possibility of  $m^*$ .<sup>24</sup> This increases the *ex post* probability  $(1 - p)$  with which  $r$  successfully seizes the civilians' cropland (part (ii), Proposition 2) and fully captures the consumption benefits of the surviving arable land, thus providing the rebels with additional incentives *ex ante* to increase atrocities against civilians.

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<sup>24</sup>That is  $\frac{\partial m^*}{\partial a} < 0$  as shown in the proof of part (i) proposition 2 in Supplemental Appendix.

Anecdotal evidence gathered from Bastar and Dantewada (in Chattisgarh, India) and Songkhla (in Thailand) further bolster our theoretical claims. To this end, first note that a report issued by India’s Home Ministry in 2005 pointed out that when the monsoon failed in 2004 in Chattisgarh over a thousand people were killed by the Naxals in Bastar and over 3000 houses were burnt by the Naxalites circulate.<sup>25</sup> Another study posited that the Naxalites in Bastar and Dantewada committed atrocities against civilians during the 2004 drought which resulted in, “150,000 people have been displaced, approximately one-third of whom were officially living in camps as of February 2006; some 500 to 1000 people have been killed and over 3000 houses burnt” (Gregory, 2013, 18). Further, results from our India district-year sample reveals (discussed below) that the outbreak of severe drought in rural croplands of India leads to statistically positive increase in civilians killed by rebels (e.g., Naxalites) operating in these croplands.

Why did the Naxalites consistently carry out such indiscriminate acts of violence against farmers in Bastar and Dantewada during the 2004 drought? To answer this question, the print media and academics have suggested that during the 2004 drought, the Naxalites (as predicted by our theory) *indiscriminately killed* farmers living in Bastar and Dantewada in 2004 to prevent consumption of limited food by rural residents; indeed, the lesser the farmers living on arable lands, the greater the amount of crops that the Naxals could consume.<sup>26</sup> Another goal the Naxalites hoped to achieve by massacring farmers and tribals in Bastar in the 2004 drought was — also suggested by our theory — to send a clear message to the local farmers<sup>27</sup> that they would be physically harmed if they did not leave their rice fields<sup>28</sup>; this meant that the Naxals were strategically using acts of murder and brutality against villagers to generate fear among the villagers as such fear would compel the villagers to run away from their rice fields<sup>29</sup> and hide in neighbouring forests (Singh, 2006; Pandita, 2011). Finally, we

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<sup>25</sup> *Ministry of Home Affairs*, “Revisiting the Naxal Problem,” 14 July 2005, Internal Security Division (Shastri Bhawan). Government of India, New Delhi, pp. 3-4.

<sup>26</sup> Shankar (2006, 91); also, see “Maoist shadow over Chhattisgarh”, *The Times of India*, 16 May 2005; Singh (2006).

<sup>27</sup> Shankar (2006, 59). Also, *Ministry of Home Affairs, op.cit.*, fn.26; Singh (2006).

<sup>28</sup> Shankar (2006); Singh (2006).

<sup>29</sup> Shankar (2006, 59-60).

describe in more depth in the Supplemental Appendix that the Naxalites in Bastar and Dantewada during the 2004 drought also recognized that forcing the civilians to flee from their fields by killing these civilians would help them to capture the rice fields, obtain stored food for consumption, and make it impossible for the farmers to build defence organizations that could challenge<sup>30</sup> the Naxalites' land appropriation goals (Singh, 2006; Shankar, 2006; Gregory, 2013).

Similarly, the BRN-C resorted to killing farmers in Rattaphum, Na Mom and Bang Klam (in Songkhla) as a tactic to evict these farmers from their rice fields when the region suffered from a serious drought in 2004 (Rattanachaya, 2004; Chongkittavorn, 2004; Srirai, 2008). In fact, the Government of Thailand's Ministry of Interior report in 2005 points out that there was a sharp (almost 90%) increase in villagers killed in Songkhla during the drought of 2004 and moreover, beheading, hangings and beatings of farmers in Songkhla became a frequent occurrence.<sup>31</sup> Some scholars also documented that during the 2004 drought in Songkhla the BRN-C killed over a thousand farmers in Rattaphum, forcefully displaced them from their fields,<sup>32</sup> and captured grain stockpiles (Chongkittavorn, 2004; Rattanachaya, 2004). Statistical estimates from our Thailand province-year sample discussed later show that intense droughts in rural crop producing regions lead to sharp increases in civilians killed by rebel groups in these regions.

Scholars and policy pundits in Thailand have suggested that the rampant killing of civilians in Songkhla during the 2004 drought was driven by strategic considerations. Indeed, as our theory predicts, the first objective behind the BRN-C led killing of civilians in Songkhla in 2004 was to send a clear signal to the farmers that their presence in the rice fields would not be tolerated; thus murdering the villagers would produce a deep-rooted fear among farmers that their lives would be in danger if they remained on their farms.<sup>33</sup> Generating fear among the farmers in Songkhla (by resorting to indiscriminate killings) to expel them from

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<sup>30</sup>See Shankar (2006); Singh (2006).

<sup>31</sup>*Ministry of Interior*, July 2005, "Civilians Attacked and Villages Raided by BRN-C in Songkhla in 2004." Bangkok: Government of Thailand.

<sup>32</sup>Davis (2005); Srirai (2008).

<sup>33</sup>Ministry of Interior, July 2005, *op. cit.*, fn.32; Also, see Chongkittavorn (2004).

their farms was seen — as suggested by our theory and as described in the Supplemental Appendix — by the BRN-C commanders as a tactic to discourage farmers from forming associations to defend their farmland and crops <sup>34</sup> and their property (Rattanachaya, 2004; Davis, 2005). The BRN-C’s second objective for killing farmers in Rattaphum, Na Mom and Bang Klam in Songkhla was driven by the need to curtail the number of individuals who could consume the limited amount of rice stored by the farmers on their croplands in the 2004 drought (Chongkittavorn, 2004; Rattanachaya, 2004; Davis, 2005). As suggested in an interview given by a captured BRN-C leader “Hama”, the BRN-C killed farmers in Rattaphum, Na Mom, Bang Klam to get them to leave their farms and prevent them from eating rice saved in *B̄ān k̄hāws* as the BRN-C wanted to consume this rice.<sup>35</sup>

Building on this detailed anecdotal evidence from Bastar, Dantewada and Songkhla, we conducted a brief statistical analysis of rebel-perpetrated atrocities within both our aforementioned district-year data for India (2002-09) and province-year data Thailand (2004-10) to evaluate key claims from our model. Our findings, discussed in full detail in the Supplemental Appendix, suggest a statistically significant positive association between severe droughts and rebel-perpetrated atrocities in these two cases. These results, and our model’s predictions, suggest the following hypothesis, which is statistically evaluated below:

- **H:** Within rural cropland areas of developing countries, severe droughts will be associated with an increased frequency of rebel-perpetrated atrocities against civilians.

## Empirical Analysis

Our hypothesis posits that drought-affected agricultural areas within developing countries will be more likely to experience rebel-perpetrated atrocities than will comparable areas that do not exhibit similar drought conditions. We test this hypothesis on a sample encompassing

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<sup>34</sup>Chongkittavorn (2004, 12). Also see Janchitfah (2004); Srirai (2008).

<sup>35</sup>Hama’s interview recorded and discussed in *Ministry of Defense*, March 2005, “Domestic Security Problems in Thailand” (White Paper), Bangkok: Supreme Command Headquarters.

14 years (1995-2008)<sup>36</sup> and 138 developing countries.<sup>37</sup> These data are first structured into a cell-year level dataset wherein cells — our cross-sectional unit of interest — are measured at the 0.5 x 0.5 decimal degree resolution<sup>38</sup> for our developing country land areas (Tollefsen et al., 2012). We then retain only those terrestrial cells that can be reasonably classified as pertaining to rural cropland areas. To achieve this, we first identify the extent of cropland within each of our developing country cells, as based upon the percentage of a cell’s area whose land cover class was determined to be (irrigated and non-irrigated) cropland by the Globcover 2009 project’s analysis of global satellite imagery data (Bontemps, Defourny and Van Bogaert, 2009), which are plotted for our developing country sample in Figure 1. We then omit all cells that were identified as having zero cropland, thereby ensuring that the remaining cells in our developing country sample most closely correspond to the “rural/agricultural” context that is assumed by our formal model.<sup>39</sup> There are approximately 26,860 total cells observed for any given year within our 1995-2008 sample period, with the average developing country in our sample containing roughly 197 cropland cells.

The dependent variable,  $atrocities_t$ , is operationalized as the yearly ( $t$ ) count of atrocities committed against civilians by insurgents within a sample cell. This measure was coded from the PITF Worldwide Atrocities Dataset, which defines atrocities as “implicitly or explicitly political, direct, and deliberate violent action resulting in the death of noncombatant civilians” (PITF, 2009, 3). The PITF uses a primary set of seven international news and NGO sources<sup>40</sup> to collect and code a reasonably systematic sample of atrocities occurring worldwide, 1995-2014, and then uses human coders to accurately record each atrocity’s geo-location. The resultant PITF data thereby limit the starting year for our sample to 1995.

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<sup>36</sup>The total temporal range for which information on our variables was available.

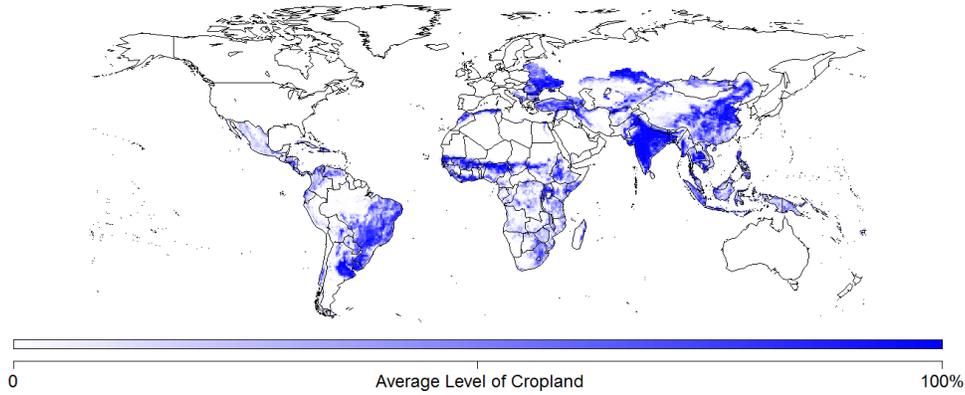
<sup>37</sup>We use the International Statistical Institute’s threshold to identify our sample countries (ISI, 2012). The developing countries included in our sample are listed in the Supplemental Appendix.

<sup>38</sup>I.e., cells of approximately 55 x 55 kilometers at the equator (3025 square kilometers area).

<sup>39</sup>Note that we (i) control for the *extent* of cropland within these remaining cells in our analysis and (ii) examine alternate “rural/agricultural” criteria in our robustness section, including samples of all developing country cells with little to no urban land (Bontemps, Defourny and Van Bogaert, 2009).

<sup>40</sup>Specifically, Agence France Presse, Associated Press, New York Times, Reuters, CNN, BBC World Monitor, All-Africa, and <http://syriansshuhada.com/>—though additional local and NGO/IGO sources can appear as primary or secondary sources in the PITF data when quoted by the aforementioned sources.

Figure 1: Cropland Levels within Developing Country Sample (1995-2008)



The PITF records information on both atrocities campaigns and atrocity incidents where five or more noncombatant deaths occurred,<sup>41</sup> and we focus on incidents to ensure comparability across cases, and to facilitate temporal aggregation. Given that our theory pertains to rebel perpetrators exclusively, we further limit our atrocity cases to atrocity incidents arising from perpetrators identified as members of nonstate organizations or groups with no allegations of state support—which correspond to roughly 33% of all atrocity incidents for our years of interest—and then sum each cell’s identified atrocity incidents to the yearly level. There are 2,446 incidents in our 1995-2008 sample, with an average cell-year count, standard deviation, and range of 0.007, 0.207, and 0-60. Additional summary statistics, histograms, and spatio-temporal plots of  $atrocities_t$  appear in the Supplemental Appendix. For our sample, a total of 75 countries experienced at least one rebel-perpetrated atrocity, underscoring our earlier contention that rebel-perpetrated atrocities are not limited to active civil wars.

Given the event count nature of  $atrocities_t$ , we employ a negative binomial (NB) model in our baseline specification below. In doing so, we are relaxing the (Poisson) mean-variance equality assumption so as to allow for a conditional variance in our observed counts that

<sup>41</sup>An incident is defined as “[a]n atrocity perpetrated by members of a single organization or communal group, or by members of multiple organizations or groups reportedly acting in concert, in a single locality within a 24-hour period” (PITF, 2009, 6), whereas campaigns correspond to a residual category for atrocities that lack sufficient information for the identification of incidents.

is larger than our count measure's conditional mean. The observed values for atrocities<sub>t</sub> lend support to this decision, as the variance of this measure (0.042) is far larger than the corresponding mean (0.007). However, there are also a disproportionate number of zero count observations in our sample, relative to positive atrocities<sub>t</sub> count values, with over 99% of all observations recording a zero value on atrocities<sub>t</sub>. Given this feature, as well as the actuality that, for many cells, atrocities were highly improbable due to either a stringent rule of law, a harmony of interests, or an absence of any human presence, many of our sample-zeroes are likely reflective of cell-years that could never have experienced atrocities under any circumstances, rather than count stage instances in which a rebel could have initiated an atrocity, but chose not to do so. Ignoring this feature, and treating all zero observations as true count stage zeroes, risks biasing our estimates. To avoid these biases, we must statistically account for the mixture of excess zeroes that exist within atrocities<sub>t</sub>.

We use a zero-inflated negative binomial (ZINB) model to do so. This approach draws upon recent studies that have recognized the potential for zero-inflated count processes within event counts of similar phenomena, including domestic conflicts arising within subnational units (e.g., Hegre, Ostby and Raleigh, 2009) and instances of violence against civilians measured at a comparable (PRIO-GRID) level of aggregation to that used here (Fjelde and Hultman, 2014). Accordingly, we build upon our baseline NB specification with a series of ZINB specifications. The latter models allow us to evaluate the effects of our covariates upon the very cases that are of most interest to the study at hand: cell-years that are *potentially* atrocity-prone. The ZINB model specifically does so by combining the results from a binary logit equation testing for whether (or not) a zero observation is likely to have been produced by the zero-only data generating process (d.g.p.) with the results of a negative binomial count equation that tests for the effect of our covariates on the expected frequency of rebel-perpetrated atrocities<sub>t</sub>, conditional on a case being non-zero inflated. We equate such a case in our application to a cell-year that is at least structurally able to experience an atrocity incident, which we can contrast with a cell devoid of any human presence or interaction due to

climate and geographic factors, or with a cell that simply lacks the opportunity for atrocities due to (i) an absence of conflict-prone social conditions or (ii) a harmony of interests.

Recall that our hypothesis expects drought-affected areas in developing countries to experience higher frequencies of rebel-perpetrated atrocities than areas not affected by drought. We thus construct a binary independent variable —  $\text{drought}_t$  — that is measured at the same 0.5 x 0.5 cell resolution as our dependent variable, and merge this to our cell-year global grid-sample. We operationalize  $\text{drought}_t$  using a Standardized Precipitation Index (SPI) that aggregates monthly precipitation data to the cell-year level (Tollefsen et al., 2012). Using monthly rainfall deviations from the local norm, the SPI classifies various forms of dryness, including (i) moderate dryness (cell-years that saw at least three consecutive months of moderate dryness) and (ii) severe dryness (cell-years that saw at least two consecutive months of severe dryness). We follow existing conventions (Tollefsen et al., 2012) and classify a “severe”  $\text{drought}_t$  as one in which both conditions i and ii are met, and code  $\text{drought}_t$  as 0 otherwise. We report summary statistics for  $\text{drought}_t$  in our Supplemental Appendix, and evaluate additional operationalizations of drought in our robustness section.

In addition to  $\text{drought}_t$ , several cell-year level controls are added to the count stage of our NB and ZINB model specifications. These variables are derived from either the PRIO-GRID (Tollefsen et al., 2012) or from the PITF’s atrocities data. We lag all time varying political-economic controls (which could mediate the effects of droughts) by one year but maintain the current-year measures for our (largely time invariant and exogenous) geographic controls. Summary statistics for all control variables are listed in Table A.1 of the Supplemental Appendix. Several of our cell-level controls were included to ensure that any findings pertaining to  $\text{drought}_t$  are robust to proximate levels of conflict and social strife. Here we include cell-level one year lags of civil conflict $_{t-1}$  presence, local ethnic diversity $_{t-1}$ ,<sup>42</sup> and the spatial lag of atrocities $_{t-1}$ . Our models also control for a cell’s broader geographic characteristics by adding each cell’s  $\ln$  cell area $_t$ ,  $\ln$  border distance $_t$ , and the percentage of a cell’s area denoted as urban and cropland (Bontemps, Defourny and Van Bogaert, 2009), each

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<sup>42</sup>I.e., a count of the number of politically relevant ethnic groups in a particular cell (Tollefsen et al., 2012).

of which is time-invariant. We account for civilian population, as well as state-penetration and economic wealth more generally, by controlling for each cell’s  $\ln \text{population}_{t-1}$ , travel time $_t$  to the nearest major city (in logged minutes) and logged gross cell product (Nordhaus, 2006). Our robustness models then further isolate the effects of drought $_t$  by controlling for additional cell-level variables such as  $\ln \text{precipitation}_t$ , and temperature $_t$ , and drought $_{t-1}$ .

In order to better ensure that it is indeed drought $_t$ —and not the country-level political-economic conditions that could potentially exacerbate the effects of droughts—that are affecting atrocities $_t$ , a larger specification presented below also includes a number of additional country-year level controls. We again lag each control by one calendar year where appropriate. These country-year control variables first account for a country’s political regime via an ordinal polity $_{t-1}$  indicator (Marshall, Jaggers and Gurr, 2013), as political regime-type is related to both atrocities against civilians (e.g., Ulfelder, 2012) and agricultural development (Bates and Block, 2013). Next, we add a country’s overall  $\ln \text{GDP pc}_{t-1}$  (World Bank, 2012), given that aggregate economic development has been shown to be associated with atrocities (Ulfelder, 2012). We then cluster our standard errors on cell-id in all models below, and add cubic polynomials for time to account for temporal dependence in our largest specifications.

Lastly, we add several control variables to the inflation-stage of our ZINB models. Recall that this stage accounts for the factors that systematically predispose some cells to be structurally (non) atrocity-prone. As population presence is a necessary condition for a cell to have at least some opportunity for rebel-perpetrated atrocities, we include our three primary population measures,  $\ln \text{travel time}_t$  to the nearest major city, urban $_t$  land area, and  $\ln \text{population}_{t-1}$  within our inflation stage. We expect these to be positively ( $\ln \text{travel time}_t$ ) and negatively (urban $_t$  and population $_t$ ) associated with inflation. Our justification for including population-oriented variables in our inflation-stages is consistent with civil conflict research (Hegre, Ostby and Raleigh, 2009; Fjelde and Hultman, 2014). We argued more generally above that stable socio-political environments, harmonies of interests, and an absence of violence each limit the opportunities for atrocities to arise within some cells

and regions. Hence, we also include our cell-level civil conflict $_{t-1}$  measure, and later our country-level indicators of polity $_{t-1}$  and ln GDP pc $_{t-1}$ , in our inflation stages. While we demonstrate above that civil conflict $_{t-1}$  does not predict rebel-perpetrated atrocities in a deterministic sense, we do believe it to affect atrocity-opportunity in a probabilistic sense. This is consistent with conflict studies employing ZINB models, which have demonstrated that past civil conflict is a robust predictor of zero-inflation in these contexts (e.g., Fjelde and Hultman, 2014; Bagozzi, 2015). Finally, while our theory contends that drought $_{t-1}$  will affect the *incidence* of atrocities $_t$ , we additionally control for drought $_{t-1}$  in the inflation stage of our large ZINB specification so as to ensure that our primary findings are also robust to the inclusion of drought $_{t-1}$  in this stage.<sup>43</sup>

### *Results*

Table 1 first reports a baseline NB model of rebel-perpetrated atrocities, which includes drought $_t$  and several key cell-level controls. This model is followed by a comparable ZINB model that includes our aforementioned cell-level inflation stage covariates, a medium ZINB specification that includes our full set of cell and country-level control variables, and then a full ZINB specification that all adds our spatial and temporal controls. All results strongly support the hypothesized effect of drought $_t$  on atrocities. The baseline NB model suggest that—controlling for a cell’s recent levels of civil conflict, population, and geographic location—increases in drought $_t$  have a statistically significant positive effect on the frequency of rebel-perpetrated atrocities. Our baseline and medium ZINB specifications similarly indicate that once one has controlled for these factors, in addition to conditioning on an observation being a potential atrocity site in year  $t$ , drought $_t$  continues to have a positive and statistically significant effect on atrocities. The full ZINB model demonstrates that this statistically significant effect of drought $_t$  remains even after further controlling for a cell’s potential spatial and temporal dependencies. Table 1 therefore supports our hypothesis and suggest that, (un)conditional on a cell being able to experience rebel-perpetrated atrocities in year  $t$ , the presence of droughts increases the rate at which civilians in that geographic

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<sup>43</sup>We thank an anonymous reviewer for this suggestion.

area experience atrocities at the hands of rebels.

Next, we examine the inflation stages of Models 2-4 to verify that our decision to use zero-inflated models was defensible. As expected, the inflation stage estimate for civil conflict $_{t-1}$  is consistently negative and significant, suggesting that civil conflicts make a cell less likely to be inflated, and thus more likely to be able to experience rebel atrocities. Ln population is negative and significant in Model 2-4, implying that more populated cells are more able to experience rebel atrocities in year  $t$ . Urban $_t$  is negative and significant in Model 2, but insignificant in Models 3-4. The former result implies that, like population, more urbanized (i.e., populated) cells are more likely to be able to experience atrocities in the present year. Controlling for these population dynamics, the negative and significant coefficient estimate on Ln travel time $_t$  in Models 3-4 implies that more rural cells are more apt to experience such conflicts. While Ln GDP pc $_{t-1}$  is not consistently significant, Polity $_{t-1}$  is negative and significant in the ZINB stage of Models 3-4, indicating that more democratic countries are more able to experience rebel-perpetrated atrocities. Finally, drought $_t$  is insignificant in our inflation stages. In sum, our inflation stage generally performs as expected, which suggests that our decision to account for inflation was correct.

To assess the substantive impact of drought $_t$ , we next turn to Table 2, which presents the percentage differences in expected values of rebel-perpetrated atrocities $_t$ , given an increase in drought $_t$  from 0 (no drought) to 1 (severe drought), and compares this first difference to those derived from two additional highly significant predictors of atrocities $_t$  (i) a 0-to-1 change in civil conflict $_{t-1}$  and (ii) one standard deviation (SD) increase in splay atrocities $_{t-1}$ . For each first difference, we hold all other variables at their means or modes.<sup>44</sup> The changes that we observe in a cell's estimated level of rebel-perpetrated atrocities in response to a extreme drought are substantial. Experiencing a severe drought is expected to lead to a 41.12% increase in the expected number of yearly rebel-perpetrated atrocities. This percentage change is (i) moderately larger to what we would expect to see given a 0-to-1 change 1SD

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<sup>44</sup>These quantities were calculated from the outcome stage of our Model 4 estimates, and thus report the effects of each variable on an (already) atrocities-prone observation.

Table 1: Count Model Estimates of Rebel-Perpetrated Atrocities, 1995-2008

	Model 1: Baseline NB	s.e.	Model 2: Baseline ZINB	s.e.	Model 3: Medium ZINB	s.e.	Model 4: Full ZINB	s.e.
<i>Count Stage</i>								
Drought <sub>t</sub>	0.313*	(0.127)	0.397*	(0.144)	0.508*	(0.218)	0.336*	(0.130)
Civil conflict <sub>t-1</sub>	2.119*	(0.095)	0.825*	(0.250)	0.919*	(0.417)	0.238*	(0.076)
Ln travel time <sub>t</sub>	0.016	(0.152)	-0.195	(0.261)	0.213	(0.353)	0.035	(0.099)
Ln cell area <sub>t</sub>	0.050	(0.134)	0.0002	(0.135)	-0.170	(0.171)	-0.105	(0.111)
Ln population <sub>t-1</sub>	0.605*	(0.064)	0.319*	(0.112)	0.588*	(0.238)	0.077	(0.064)
Ln GCP <sub>t-1</sub>	.	.	.	.	-0.174	(0.136)	-0.019	(0.083)
Polity <sub>t-1</sub>	.	.	.	.	-0.081	(0.029)	-0.001	(0.007)
Ln border distance <sub>t</sub>	.	.	.	.	0.378*	(0.074)	0.025	(0.025)
Urban <sub>t</sub>	.	.	.	.	0.033	(0.034)	0.019	(0.020)
Cropland <sub>t</sub>	.	.	.	.	-0.009*	(0.003)	-0.001	(0.002)
Ethnic Diversity <sub>t-1</sub>	.	.	.	.	-0.039	(0.075)	-0.044	(0.034)
Ln GDP pc <sub>t-1</sub>	.	.	.	.	0.546*	(0.167)	-0.019	(0.072)
Splag Atrocities DV <sub>t-1</sub>	.	.	.	.	.	.	0.645*	(0.149)
<i>t</i>	.	.	.	.	.	.	-40.149*	(0.134)
<i>t</i> <sup>2</sup>	.	.	.	.	.	.	20.061*	(0.078)
<i>t</i> <sup>3</sup>	.	.	.	.	.	.	-3.459*	(0.014)
Constant	-0.478	(0.779)	-6.361*	(1.955)	12.354*	(5.627)	0.016	(1.412)
<i>Inflation Stage</i>								
Ln population <sub>t-1</sub>	.	.	-0.354*	(0.134)	-0.412*	(0.210)	-0.458*	(0.063)
Ln travel time <sub>t</sub>	.	.	-0.333	(0.227)	-0.072*	(0.231)	-0.684*	(0.132)
Civil conflict <sub>t-1</sub>	.	.	-1.827*	(0.198)	-2.727*	(0.282)	-5.408*	(0.097)
Urban <sub>t</sub>	.	.	-0.124*	(0.041)	-0.123	(0.068)	-0.038	(0.022)
Ln GDP pc <sub>t-1</sub>	.	.	.	.	1.146*	(0.467)	-0.186	(0.103)
Polity <sub>t-1</sub>	.	.	.	.	-0.162*	(0.062)	-0.042*	(0.013)
Drought <sub>t</sub>	.	.	.	.	0.307	(0.302)	-0.017	(0.228)
Constant	.	.	8.092*	(1.910)	-2.325	(7.664)	-10.814	(1.785)
Observations	366,124		366,124		333,243		333,243	
Log-psuedolikelihood	-9,593.36		-9,499.24		-7,197.42		-1,665.74	

Note: \* indicates  $p < 0.05$ ; values in parentheses are robust standard errors clustered by cell-id.

Table 2: Percentage Change in Expected Atrocities Count in Year  $t$

Drought <sub>t</sub>	Civil conflict <sub>t-1</sub>	Splag Atrocities DV <sub>t-1</sub>
+41.12%	+27.23%	+1.98%
(+8.64% ↔ +80.77%)	(+9.42 ↔ +47.03)	(+1.09% ↔ +2.87%)

Note: Drought<sub>t</sub> and civil conflict<sub>t-1</sub> were each changed from 0 → 1. Splag Atrocities DV<sub>t-1</sub> was increased 1SD above its mean. Values in parentheses are 95% confidence intervals.

increase in civil conflict $_{t-1}$  (+27.13%), and substantially larger than the effect of a 1SD change in a splag atrocities $_{t-1}$  (+1.98%). Hence, the first-differences presented in Table 2 indicate that the substantive effects of drought $_t$  are indeed sizable.

### *Robustness Tests*

To evaluate the sensitivity of our findings, we examine a number of alternative specifications in the Supplemental Appendix. For these robustness tests, we estimate the “full” ZINB-specification presented in Table 1 and then assess the statistical significance of each drought coefficient estimate therein. To begin, we first separately verify that our results are robust to the inclusion of (i) year fixed effects and (ii) a spatially lagged dependent variable in inflation stage of our full ZINB-specification. We then assess whether our findings for drought $_t$  are arising due to omitted variable bias, with particular regard to a selection of additional controls for a country’s degree of ethnic fractionalization, polity $^2_{t-1}$ , a cell’s annual temperature, each cell’s (logged) level of annual precipitation, and cell-level government perpetrated atrocities $_{t-1}$ . Our primary conclusions remain after adding these additional controls.<sup>45</sup> We next evaluate an alternative operationalization of drought $_t$  by including the complete SPI (discussed above) in place of drought $_t$ . Our findings remain comparable when using this more graded measure of (extreme) local dryness.

Likelihood ratio tests favor the ZINB over the ZIP for all models in Table 1. Nevertheless, we also verify that our findings are robust to the latter. Our developing country sample is global, whereas the study of atrocities, as well as studies of the effects of climatic factors on political violence, have predominately focused on the African continent. Addressing this distinction, we find that our results are robust to an exclusive focus on the African continent. We likewise obtain positive and significant findings for drought $_t$  when using a dependent atrocities variable derived from the Georeferenced Events Dataset (GED; Sundberg and Melander, 2013) as opposed to our PITF-based measure. We next examine a model that uses a sample of all developing country “rural” grid-cells based upon whether urban land area

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<sup>45</sup>Though drought $_t$  is now only significant at the  $p < .10$  level.

is scarce to nonexistent, rather than based upon whether some positive amount of cropland is present. This robustness model indicates that our primary conclusions hold under this alternative threshold for a (rural) cell’s inclusion in our sample. Lastly, we also evaluate the robustness of all models reported in Table 1 while including all developing country grid-cells—and find that our conclusions are robust to these adjustments as well.

## Conclusion

This paper contends that droughts can increase the incidence of rebel-perpetrated atrocities against civilians in agricultural areas of developing countries. When severe droughts occur, our formal model posits that agriculture resources diminish, leading civilians to allocate more agricultural supplies for consumption, and to invest more in defending their diminishing supplies. In response, rebels will attempt to preempt civilians’ defensive efforts by seeking to forcibly evict civilians from their homes and croplands. This strategy drives rebels to commit atrocities, as atrocities induce civilians to flee from their land or otherwise give-up food resources. After deriving these propositions formally, we empirically establish that droughts are a consistent positive indicator of rebel-perpetrated atrocities against civilians.

Our findings have a number of important implications for the study of violence against civilians. In recent years, the study of rebel-perpetrated atrocities has greatly benefited from numerous exceptional theories of the strategic dynamics underlying rebels’ decisions to employ violence against civilians within conflict settings (e.g., Azam and Hoeffler, 2002; Wood, 2010; Fjelde and Hultman, 2014). Yet, as noted above, a high proportion of contemporary rebel-perpetrated atrocities not only occur predominantly within agricultural regions, but also transpire in locations that are not currently experiencing active fighting between rebels and government forces. To explain this variation, we develop a game-theoretic model that does not necessitate the existence of active civil conflict as a prerequisite for violence against civilians. Drawing on extant research concerned with the effects of climatic factors on conflict (e.g., Burke et al., 2009; Buhaug, 2010; Hendrix and Salehyan, 2012), we then find drought to be an important causal mechanism in promoting atrocities in rural developing areas.

These contributions represent an important step forward in advancing our understandings of political violence and the factors governing its variation.

Given the likelihood of more severe global droughts in future years due to climate change (Vidal, 2013), the identified linkages between droughts and atrocities also have important policy relevance. Indeed, this study has not only identified a salient predictor of atrocities, but has also illuminated a possible mechanism by which a subset of atrocities could be ameliorated; through better drought preparedness and agricultural assistance within atrocity prone regions of the world. Our findings also suggest that improved food security may more generally help regions avoid atrocities both during and between periods of active fighting. A key insight of our theory is that food insecurity, and drought-based shocks to food security, can undermine food access, which in turn increases rebel forces' pursuit of violence against civilians and the levels of civilian resistance in response to such tactics. These trends are apt to grow in the future, as the effects of climate change increasingly undermine food security in the developing world. As such, the study of climate change's varied effects on atrocities against civilians represents an especially compelling area for future research.

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## References

- Arrow, K. J., H. B. Chenery, B. S. Minhas and R. M. Solow. 1961. "Capital-Labor Substitution and Economic Efficiency." *The Review of Economics and Statistics* 43(3):225–250.
- Azam, Jean-Paul and Anke Hoeffler. 2002. "Violence Against Civilians in Civil Wars: Looting or Terror?" *Journal of Peace Research* 39(4):461–485.
- Bagozzi, Benjamin E. 2015. "Forecasting Civil Conflict with Zero-Inflated Count Models." *Civil Wars* 17(1):1–24.
- Bates, Robert H. and Steven A. Block. 2013. "Revisiting African Agriculture: Institutional Change and Productivity Growth." *Journal of Politics* 75(2):372–384.
- Bontemps, Sophie, Pierre Defourny and Eric Van Bogaert. 2009. "Globcover 2009. Products Description and Validation Report." European Space Agency.
- Buhaug, Halvard. 2010. "Climate not to blame for African civil wars." *Proceedings of the National Academy of Science* 107(38):16477–16482.
- Burke, M., E. Miguel, S. Satyanath, J. Dykema and D. Lobell. 2009. "Warming Increases the Risk of War in Africa." *Proceedings of the National Academy of Science* 106:20670–20674.
- Chongkittavorn, K. 2004. "One Decade and a Year of Violence in the Southern Border: Mysteries of the Problem and Solution." Paper, Faculty of Humanities & Social Science, Pattani University.
- Cutler, Peter. 1986. "The response to drought of Beja famine refugees in Sudan." *Disasters* 10(3):181–188.
- Davis, Anthony. 2005. "No End in Sight for Southern Thailand's Escalating Insurgency." *Jane's Intelligence Review*, March 2005.
- Eck, Kristine and Lisa Hultman. 2007. "One-Sided Violence Against Civilians in War: Insights from New Fatality Data." *Journal of Peace Research* 44(2):233–246.

- Fjelde, Hanne. 2015. "Farming or Fighting? Agricultural Price Shocks and Civil War in Africa." *World Development* 67:525–534.
- Fjelde, Hanne and Lisa Hultman. 2014. "Weakening the Enemy: A Disaggregated Study of Violence against Civilians in Africa." *Journal of Conflict Research* 58(7):1230–1257.
- Gitlitz, John S and Telmo Rojas. 1983. "Peasant Vigilante Committees in Northern Peru." *Journal of Latin American Studies* 15(1):163–197.
- Gregory, Christopher. 2013. *The Modern Anthropology of India: Ethnography, Themes and Theory*. Abington, UK: Routledge chapter Chhattisgarh: At the Crossroads.
- Hansen, Stig Jarle. 2013. *Al-Shabaab in Somalia: The History and Ideology of a Militant Islamist Group, 2005-2012*. London, UK: Hurst and Co.
- Hegre, Haavard, Gudrun Ostby and Clionadh Raleigh. 2009. "Poverty and Civil War Events: A Disaggregated Study of Liberia." *Journal of Conflict Resolution* 53(4):598–623.
- Helbardt, S. 2011. "Deciphering Southern Thailand's Violence: Organisation and Insurgent Practices of BRN-Coordinate." Ph.D. thesis, University of Passau, Germany.
- Hendrix, Cullen S. and Hen-Jan Brinkman. 2013. "Food Security and Conflict Dynamics." *Stability: International Journal of Security and Development* 2(2).
- Hendrix, Cullen S. and Idean Salehyan. 2012. "Climate Change, Rainfall, and Social Conflict in Africa." *Journal of Peace Research* 49(1):35–50.
- Henk, Daniel W. and Martin Revayi Rupiya. 2001. *Funding Defense: Challenges of Buying Military Capability In Sub-Saharan Africa*. Carlisle, PA: U.S. Army War College.
- Hultman, Lisa. 2007. "Battle Losses and Rebel Violence: Raising the Costs for Fighting Terrorism and Political Violence." *Terrorism and Political Violence* 19(2):205–222.
- ISI. 2012. "ISI Developing Countries." <http://www.isi-web.org/component/content/article/5-root/root/577-developing2012>.

- Janchitfah, S. 2004. *Violence in the Mist: Reporting on the Presence of Pain in Southern Thailand*. Bangkok: Kobfai Publishing Project.
- Kalyvas, Stathis N. 2006. *The Logic of Violence in Civil War*. Cambridge: Cambridge University Press.
- Keen, David. 2005. *Conflict and Collusion in Sierra Leone*. Suffolk: James Currey.
- Koren, Ore. 2014. "Military Structure, Civil Disobedience, and Military Violence." *Terrorism and Political Violence* 26(4):688–712.
- Marshall, M. G., T. R. Jagers and K. Gurr. 2013. "Polity iv project: Political regime characteristics and transitions, 1800-2012." Technical Report.
- Mkandawire, Thandika. 2002. "The Terrible Toll of Post-Colonial 'Rebel Movements' in Africa: Towards an Explanation of the Violence against the Peasantry." *Journal of Modern African Studies* 40(2):181–215.
- Mkutu, Kennedy. 2001. "Pastoralism and conflict in the Horn of Africa." Africa Peace Forum/Saferworld/University of Bradford.
- National-Statistics-Office. 1985. "Statistical Yearbook of Thailand, 1985." Bangkok: Office of the Prime Minister.
- Nordhaus, William D. 2006. "Geography and macroeconomics: New data and new findings." *Proceedings of the National Academy of Sciences* 103(10):3150–3517.
- NREGA. 2010. "NREGA annual reports 2004-2010." Ministry of Rural Development.
- Pandita, Rahul. 2011. *Hello, Bastar: the untold story of India's Maoist movement*. Chennai: Tranquebar Press.
- PITF. 2009. "Political Instability Task Force Worldwide Atrocities Event Data Collection Codebook Version 1.0B2." Version: pitf.world.19950101-20130930.csv.

- Rattanachaya, K. 2004. *Revealing the Igniting of the Southern Fire* Establishing a Pattani State. Bangkok: Phichit Printing.
- Roncoli, Carla, Keith Ingram and Paul Kirshen. 2001. "The costs and risks of coping with drought: livelihood impacts and farmers' responses in Burkina Faso." *Climate Research* 19:119–132.
- Salehyan, Idean, David Siroky and Reed M. Wood. 2014. "External Rebel Sponsorship and Civilian Abuse: A Principal-Agent Analysis of Wartime Atrocities." *International Organization* 68(3):633–661.
- Shankar, P. 2006. *Yeh Jungle Hamara Hai*. Delhi, India: New Vistas.
- Singh, Parakash. 2006. *The Naxalite Movement in India*. New Delhi, India: Rupa Publications Ltd.
- Skaperdas, Stergios. 1996. "Contest Success Functions." *Economic Theory* 7(2):283–290.
- Srirai, S. 2008. "The BRN-Coordinate Movement and the Insurgency in the 3 Border Provinces and 4 Districts of Songkhla Province in the Period 2005-2007." PhD dissertation, National Defence College, Thailand.
- Sundberg, Ralph and Erik Melander. 2013. "Introducing the UCDP Georeferenced Event Dataset." *Journal of Peace Research* 50(4):523–532.
- Theisen, Ole Magnus, Nils P Gleditsch and Halvard Buhaug. 2013. "Is climate change a driver of armed conflict?" *Climatic Change* 117:613–625.
- Tollefsen, Andreas Forø, Håvard Strand and Halvard Buhaug. 2012. "PRIO-GRID: A Unified Spatial Data Structure." *Journal of Peace Research* 49(2):363–374.
- Ulfelder, Jay. 2012. "Forecasting Onsets of Mass Killing." Paper prepared for presentation at the annual Northeast Political Methodology Meeting.

- Urdal, Henrik. 2008. "Population, resources and violent conflict: a sub-national study of India 1956-2002." *Journal of Conflict Resolution* 52(4):590–617.
- Valentino, Benjamin, Paul Huth and Dylan Balch-Lindsay. 2004. "'Draining the Sea:' Mass Killing and Guerilla Warfare." *International Organization* 58(2):375–407.
- Vidal, John. 2013. "Climate change will hit poor countries hardest, study shows." *The Guardian*. 9/27/2013.
- Weinstein, Jeremy M. 2005. "Resources and the Information Problem in Rebel Recruitment." *Journal of Conflict Resolution* 49(4):598–624.
- Weinstein, Jeremy M. 2007. *Inside Rebellion: The Politics of Insurgent Violence*. Cambridge, UK: Cambridge University Press.
- Wischnath, Gerdis and Halvard Buhaug. 2014. "Rice or riots: On food production and conflict severity across India." *Political Geography* 43:6–15.
- Wood, Reed M. 2010. "Rebel Capability and Strategic Violence Against Civilians." *Journal of Peace Research* 47(5):601–614.
- Wood, Reed M. and Christopher Sullivan. 2015. "Doing Harm by Doing Good? The Negative Externalities of Humanitarian Aid Provision during Civil Conflict." *Journal of Politics* 77(3):736–748.
- Wood, Reed M. and Jacob D. Kathman. 2013. "Too Much of a Bad Thing? Civilian Victimization and Bargaining in Civil War." *British Journal of Political Science* 44(3).
- Wood, Reed M., Jacob D. Kathman and Stephen E. Gent. 2012. "Armed Intervention and Civilian Victimization in Intrastate Conflicts." *Journal of Peace Research* 49(5):647–660.
- World Bank. 2012. *World Development Indicators 2012*. World Bank Publications.

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